WHAT IS CLAIMED IS:

1. A method for measuring the mass of a substance, the method comprising:

applying energy to a substance;

measuring a response resulting from the application of energy; and

determining the mass of the substance based on the measured response.

2. A method as in claim 1, further comprising volumetrically metering the substance prior to applying the energy.

3. A method as in claim 2, wherein the substance comprises a powder, and wherein the metering step comprises depositing the powder within a metering chamber.

4. A method as in claim 1, wherein the energy applying step comprises directing electromagnetic radiation onto the substance.

5. A method as in claim 1, wherein the energy applying step comprises directing light onto the substance.

6 A method as in claim 5, wherein the measuring step comprises measuring light transmitted through the substance, and wherein the determining step comprises correlating the measured light with an associated mass.

7. A method as in claim 5, wherein the measuring step comprises measuring light emitted from the substance, and wherein the determining step comprises correlating the measured light with an associated mass.

8. A method as in claim 5, wherein the measuring step comprises measuring an interference pattern caused by transmitted or emitted light from the substance interfering with the light directed onto the substance, and wherein the determining step comprises correlating the interference pattern with an associated mass.

9. A method as in claim 1, wherein the energy applying step comprises applying current or voltage to the substance, wherein the measuring step comprises measuring the impedance of the substance, and wherein the determining step comprises correlating the impedance with an associated mass.

10. A method as in claim 1, wherein the energy applying step comprises applying vibrational energy to the substance, and wherein the measuring step comprises measuring the energy dissipation caused by the substance.

11. A method as in claim 10, wherein the step of applying vibrational energy comprises vibrating a piezoelectric element to subject the substance to pressure changes, wherein the measuring step comprises measuring the vibrational frequency of the piezoelectric element after energy has been dissipated by the substance, and wherein the determining step comprises comparing the measured vibrational frequency with a natural oscillating frequency of the piezoelectric element, and correlating the change in frequency with an associated mass.

12. A method as in claim 1, further comprising comparing the determined mass with a range of masses that defines an acceptable unit mass range to determine whether the measured substance is within the acceptable range.

13. A method as in claim 1, further comprising processing the response using tomography.

14 ~~13~~. A method for determining whether a metered volume of a substance contains a unit mass, the method comprising;

filling a metering chamber defining a certain volume with a substance;

applying energy to the substance while within the metering chamber;

measuring a response resulting from the application of energy; and

determining the mass of the substance based at least in part on the measured response.

15 ~~14~~. A method as in claim 14, further comprising comparing the determined mass with a range of masses that defines an acceptable unit mass range to determine whether the determined mass falls within the acceptable range.

16 ~~15~~. A method as in claim 14, further comprising ejecting the substance from the metering chamber, and applying the energy and measuring the response while the ejected powder is traveling away from the metering chamber.

17 ~~16~~. A method for measuring the mass of a substance, the method comprising:

directing a beam of radiation onto a substance;

measuring the transmittance or emittance of radiation from the substance, or an interference pattern caused by transmitted or emitted radiation from the substance interfering with the beam; and

determining the mass of the substance based at least in part on the measured transmittance or emittance of radiation, or the interference pattern.

18 ~~17~~. A method as in claim 17, further comprising depositing the substance within a metering chamber and passing the beam through the metering chamber.

19 ~~18~~. A method as in claim 18, wherein the substance comprises a powder, and wherein the depositing step comprising drawing the powder into the metering chamber with a vacuum.

20 ~~19~~. A method as in claim 17, further comprising comparing the determined mass with a range of masses that defines an acceptable unit mass range to determine whether the measured substance is within the acceptable range.

21 ~~20~~. A method for determining whether a unit mass of a substance has been metered, the method comprising:

passing a calibrating beam of radiation at a certain intensity through a metering chamber that defines a certain volume;

measuring the intensity of the calibrating beam after passing through the chamber;

filling the chamber with a substance;

passing a measuring beam of radiation at the certain intensity through the substance;

measuring the intensity of the measuring beam after passing through the substance;

determining the transmittance of the measuring beam through the substance; and

determining the mass of the substance based at least in part on the transmittance of the measuring beam.

22 ~~21~~. A method as in claim 21, wherein the transmittance is determined by subtracting the measured intensity of the measuring beam from the measured intensity of the calibrating beam.

23 ~~22~~. A method as in claim 21, wherein the substance comprises a powder, and wherein the depositing step further comprises drawing a vacuum within the metering chamber to assist in capturing falling powder into the chamber.

24 ~~23~~. A method as in claim 23, wherein the metering chamber includes a filter upon which the substance rests, and further comprising passing the calibrating beam and the measuring beam through the filter.

25 ~~24~~. A method as in claim 23, wherein the metering chamber is included within a rotatable drum, and further comprising rotating the drum between multiple positions where the intensity of the calibrating beam is measured, where the powder is deposited in the chamber, and where the intensity of the measuring beam is measured.

26 ~~25~~. A method as in claim 25, further comprising rotating the drum to another position and ejecting the powder from the chamber and into a receptacle.

27 ~~26~~. A method as in claim 26, further comprising repeating the step of rotating the drum between the multiple positions to deposit another mass of powder into another receptacle.

28 ~~27~~. A method as in claim 21, further comprising comparing the determined mass with a range of masses that defines an acceptable unit mass range to determine whether the measured substance is within the acceptable range.

29 ~~28~~. A method as in claim 28, further comprising varying the amount of vacuum and/or the rate at which the powder is permitted to fall in a subsequent filling of the metering chamber based on the value of the measured mass in comparison to the acceptable range of masses.

30 ~~29~~. A system for measuring the mass of a substance, the system comprising:

a metering chamber that defines a certain volume and that is adapted to receive a substance;

an energy source disposed to supply energy to the substance;

at least one sensor to measure a response from the substance due to the application of energy from the energy source; and

a processor coupled to the sensor to determine a mass of the substance held within the metering chamber based at least in part on the measured response.

31 ~~30~~. A system as in claim 30, wherein the energy source comprises a source of electromagnetic radiation disposed to direct electromagnetic radiation onto the substance.

32 ~~31~~. A system as in claim 31, wherein the sensor is selected from a group of sensors consisting of a radiometer and a reflectometer.

33 ~~32~~. A system as in claim 31, wherein the processor is configured to determine the mass of the substance by correlating transmitted or emitted light measured by the sensor with an associated mass.

34 ~~33~~. A system as in claim 31, wherein the processor is configured to determine the mass of the substance by correlating a measured interference pattern measured by the sensor with an associated mass.

35 ~~34~~. A system as in claim 30, wherein the energy source comprises an electrode that is adapted to pass electrical current through the substance, wherein the sensor comprises a sensing electrode and circuitry to measure the capacitance of the substance.

36 ~~35~~. A system as in claim 30, wherein the energy source comprises a vibratable element that is adapted to apply vibrational energy to the substance, and wherein the sensor is configured to measure an amount of energy dissipation caused by the substance.

37 ~~36~~. A system as in claim 36, wherein the vibratable element comprises a piezoelectric element that is adapted to supply pressurize air pulses to the substance, wherein the sensor further comprises circuitry to determine the vibrational frequency of the piezoelectric element after energy has been dissipated by the substance, and wherein the processor is configured to compare the measured vibrational frequency with a natural oscillating frequency of the piezoelectric element, and to correlate the change in frequency with an associated mass.

38 ~~37~~. A system as in claim 36, wherein the processor is further configured to compare the determined mass with a range of masses that defines an acceptable unit mass range to determine whether the measured substance is within the acceptable range.

39 ~~38~~. A system for measuring the mass of a substance, the system comprising:

a metering chamber that defines a certain volume and that is adapted to receive a substance;

a radiation source disposed to pass a beam of radiation through the metering chamber;

at least one sensor to detect radiation transmitted or emitted from the substance; and

a processor coupled to the sensor to determine a mass of the substance held within the metering chamber based at least in part on the detected radiation.

40 ~~39~~. A system as in claim 39, wherein the processor is further configured to determine the mass of the substance by associating the loss of transmitted light, an interference pattern, or the stimulation of fluorescence with a stored mass value.

41 ~~40~~. A system as in claim 40, wherein the processor is configured to determine the loss of transmitted light by comparing an intensity value of the beam after passing through the substance with an intensity value of a beam from the radiation source passing through the chamber in the absence of the substance.

42 ~~41~~. A system as in claim 39, wherein the metering chamber includes a filter at a bottom end upon which the substance is adapted to rest, and wherein the

radiation source is disposed to pass a beam through the filter and then through the chamber.

43 42. A system as in claim 42, further comprising a vacuum source in communication with the chamber to assist in drawing the substance into the chamber.

44 43. A system as in claim 43, further comprising a rotatable drum in which the chamber is disposed, and wherein the radiation source is included within the drum.

45 44. A system as in claim 44, further comprising a powder fluidization apparatus disposed above the drum that is adapted to supply fluidized powder to the chamber.

46 45. A system as in claim 45, further comprising a pair of sensors, and wherein the processor is configured to rotate the chamber past one of the sensors when the chamber is empty of powder, to rotate the chamber into alignment with the powder fluidization device to permit the chamber to be filled with powder, and to rotate the chamber past the other sensor when the chamber is filled with powder.

47 46. A system as in claim 46, further comprising code used by the processor to compare the determined mass of the powder with a range of acceptable mass values, and wherein the processor is configured to alter the amount of vacuum and/or operation of the fluidization apparatus depending on the outcome of the comparison.

48 47. A system as in claim 39, further comprising code used by the processor that includes a relationship between the amount of transmitted light, an interference pattern, or the amount of fluorescence and the associated mass of the substance when the substance fills the chamber.

49 48. A system as in claim 39, wherein the radiation source comprises a laser and wherein the sensor comprises a lens and a radiometer.